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STOPPER APPARATUS FOR SLIDE RAIL

BACKGROUND OF THE INVENTION

The present invention relates to a stopper apparatus for a slide rail provided between a body and a drawer or the like.

In general, a slide rail is provided with a first rail and a second rail as disclosed in Japanese Utility Model No. 2541480. Each first rail of a pair of the slide rails is fixed to left and right side portions of a housing portion of a body, respectively, such that the longitudinal direction thereof is in alignment with the back and forth direction. Meanwhile, each second rail of the pair of slide rails is fixed to left and right side portions of a drawer housed in the housing portion of the body, respectively. Moreover, each second rail is supported so as to be movable in the back and forth direction by the corresponding first rail. Consequently, the drawer is supported so as to be movable in the back and forth direction by the housing portion of the body through the pair of slide rails.

A stopper apparatus is provided between the first rail and the second rail of the slide rail. The stopper apparatus, for example, inhibits the second rail from moving forward further than a predetermined position with respect to the first rail, thereby inhibiting the drawer from falling out of the body. The stopper member is provided with a lock portion which is mounted on a face facing the second rail (i.e., an inner face) of the first rail, such that the lock portion projects toward the second rail, and a stopper member which is formed in a face facing the first rail (i.e., an inner face) of the second rail.

The stopper member is formed of an elastic metal plate material. It has an attachment portion fixed to the second rail, a sloping plate portion (plate portion) which is formed so as to be continuous with a front end portion of the attachment portion and which is inclined such that a front portion of the sloping plate portion is closer to the first rail than the rear portion thereof, and a guide portion which is formed so as to be continuous

with a front end portion of the sloping plate portion such that a front portion of the guide portion is closer to the second rail than the rear portion thereof. A lock hole (lock recess portion) is formed in the front end portion of the sloping plate portion into which the lock portion is received so as to freely get in and come out of the lock hole. The guide portion contacts the lock portion when the second rail moves in the forward direction to a predetermined first position. Therefore, when the second rail moves further in the forward direction, the guide portion slides on the lock portion. Consequently, the sloping plate portion is elastically deformed so as to approach the second rail. Subsequently, when the second rail moves to a predetermined second position, the lock hole faces the lock portion. Then, the sloping plate portion is elastically deformed so as to return to the original position such that the front end portion of the sloping plate portion approaches the first rail, and the lock portion is received in the lock hole. When an attempt is made to move the second rail in the forward direction with the lock portion being received in the lock hole, a rear end face of the lock hole contacts the lock portion, whereby the second rail 2 is inhibited from moving in the forward direction.

In the conventional stopper apparatus as described above, in order to reliably inhibit the second rail from moving forward further than the predetermined second position, it is necessary that when the second rail moves to the second position, the lock portion be reliably received in the lock hole and that this state be reliably maintained. In order to achieve this, a modulus of elasticity of the stopper member, particularly a modulus of elasticity of the sloping plate portion needs to become larger. By doing so, elastic force becomes large when the sloping plate portion returns to the original state, whereby the lock portion is reliably received in the lock hole. However, if elastic return force of the sloping plate portion is made larger by increasing the modulus of elasticity thereof, large stress is generated in the sloping plate portion when the sloping plate portion is elastically deformed

toward the second rail by the guide portion. Particularly, large stress is generated at an intersection portion of the sloping plate portion and the attachment portion. Therefore, the stopper member could be damaged at the intersection portion of the sloping plate portion and the attachment portion at an early time.

Note that when the modulus of elasticity of the sloping plate portion is made smaller, stress generated in the sloping plate portion becomes also small, thereby preventing the stopper member from being damaged at an early time. In this case, however, since the sloping plate portion is elastically deformed even by small force, the lock portion may easily get out of the lock hole when force in the forward direction acts on the second rail. This makes it difficult to reliably inhibit the second rail from moving forward further than the predetermined second position.

SUMMARY OF THE INVENTION

In order to solve the aforementioned problems, it is an object of the present invention to provide a stopper apparatus for a slide rail. The stopper apparatus for a slide rail having a first rail and a second rail which are coupled so as to be capable of mutual relative movement in a longitudinal direction, the stopper apparatus is characterized by comprising:

a lock portion which projects toward the second rail and which is formed in a distal end portion of an inner face of the first rail, this inner face facing the second rail;

a stopper member made of an elastic plate material formed in a rear end portion of the inner face of the second rail, facing the first rail; the stopper member comprising:

an attachment portion which is formed in a base end portion of the stopper member, and which is fixed to the inner face of the second rail;

a plate portion which is formed so as to be continuous with a

distal end portion of the attachment portion, and which extends toward the distal end portion of the second rail such that the plate portion is separated from the inner face of the second rail; and

a guide portion which is formed so as to be continuous with the distal end portion of the plate portion, such that, when the second rail moves toward the distal end side and reaches a predetermined first position, the guide portion contacts the lock portion, and slides on the lock portion in accordance with movement of the second rail from the first position to the distal end side, thereby elastically displacing the plate portion around the base end portion to the second rail side,

the plate portion further comprising:

a lock recess portion formed in the distal end portion such that, when the second rail moves further from the first position toward the distal end side and reaches the predetermined second position, the lock recess portion faces the lock portion, and receives the lock portion due to the plate portion being elastically deformed to return to the second rail side, and thereby inhibiting the second rail from moving in the longitudinal direction by engagement of the lock portion with the lock recess portion; and

an elastic strip which projects toward the second rail and which elastically urges the plate portion to the inner face side of the first rail by contacting an abutment portion formed in the second rail; wherein

when the lock portion is received in the lock recess portion, a distance between the elastic strip and the abutment portion in a direction in which the inner face of the first engagement portion and the inner face of the second engagement portion face each other is set smaller than an

insertion distance of the lock portion into the lock recess portion.

In this case, the second rail may be inhibited from moving toward the distal end side by contact of the lock portion with a rear end face of the lock recess portion, and the second rail may be inhibited from moving toward the rear end side by contact of the lock portion with a distal end face of the lock recess portion.

It is preferable that the elastic strip is inclined such that a front portion of the elastic strip is closer to the second rail than the distal end portion thereof so as to also serve as the guide portion, and, when the second rail moves toward the distal end side and reaches the first position, a face of the elastic strip facing the first rail contacts the lock portion.

It is also preferable that a thorough hole which receives the distal end portion is further formed in the second rail, and the abutment portion is formed at an intersection portion of the inner peripheral face of the through hole and the inner face of the second rail.

The stopper apparatus may further including a fixed rail and a movable rail such that longitudinal directions thereof are in alignment with longitudinal directions of the first rail and the second rail, wherein the movable rail is coupled to the fixed rail so as to be movable in the longitudinal direction of the fixed rail and the first rail is fixed to the movable rail.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded perspective view of a first embodiment of the present invention;

FIG. 2 is a cross sectional view showing how the first embodiment is used;

FIG. 3 is a sectional view of a main portion of the first embodiment with a state where a second rail moves to a first position;

FIG. 4 is a sectional view of the main portion with a state where the

second rail moves to a second position, which is similar to FIG. 3;

FIG. 5 is a sectional view of the main portion with a state where a lock plate portion is received in a lock hole, which is similar to FIG. 3;

FIG. 6 is a sectional view of the main portion with a state where the lock plate portion gets out of the lock hole, which is similar to FIG. 3;

FIG. 7 is an exploded perspective view of a second embodiment of the present invention;

FIG. 8 is an exploded perspective view of a third embodiment of the present invention; and

FIG. 9 is an exploded perspective view of a fourth embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, embodiments of the present invention will be explained referring to FIGS. 1 to 9.

FIGS. 1 to 6 show a first embodiment of the present invention. First, an explanation will be given of a slide rail 1 on which a stopper apparatus 6 according to the present invention (see FIGS. 3 to 6) is attached. As shown in FIGS. 1 and 2, the slide rail 1 includes a first rail 2, a second rail 3 disposed facing the first rail 2, and a slider 4 which couples the second rail 3 movably to the first rail 2.

The first rail 2, made of a rigid metal plate material, has a flat plate portion 2a with an elongated rectangular plate-like shape. The flat plate portion 2a is fixed to one of side faces of a housing portion A1 of a body A (see FIG. 2) with a screw (not shown) or the like, such that the longitudinal direction of the flat plate portion 2a is in alignment with the back and forth direction. It is needless to say that a flat plate portion 2a of a first rail 2 of another slide rail 1 is fixed to the other side face of the housing portion A1. Rail portions 2b, 2b projecting toward the second rail 3 are formed in both upper and lower side portions of the flat plate portion 2a covering the entire

length thereof. Each rail portion 2b has a generally arc-shaped cross section, and expands in the outward direction (i.e., upward and downward directions in FIG. 2). Guide members 5 are attached to front end portions (i.e., distal end portions) of inner faces of rail portions 2b, 2b opposing each other, respectively. A stopper plate portion 2c is formed in a rear end portion of the flat plate portion 2a such that the stopper plate portion 2c projects toward the second rail 3. A pair of lock plate portions (lock portions) 2d, 2d are formed in a front end portion of an inner face of the flat plate portion 2a, that faces the second rail 3, by cutting and raising a part of the flat plate portion 2a. The lock plate portions 2d, 2d are separated from each other with a predetermined interval and face each other in the vertical direction.

The second rail 3, made of a rigid metal plate material, has a flat plate portion 3a with an elongated rectangular plate-like shape. The flat plate portion 3a with the longitudinal direction thereof being in alignment with the back and forth direction, is fixed to one of side faces of a drawer B (see FIG. 2) which is housed so as to be movable in the back and forth direction in the housing portion A1 with a screw (not shown) or the like. It is needless to say that a flat plate portion 3a of a second rail 3 of another slide rail 1 is fixed to the other side face of the drawer B. The flat plate portion 3a is positioned at the same position as the flat plate portion 1a in the vertical direction, such that the flat plate portion 3a faces the flat plate portion 2a in the right and left direction. The flat plate portion 3a has a smaller width in the vertical direction than the flat plate portion 2a. Rail portions 3b, 3b projecting toward the first rail 2 are formed in both upper and lower side portions of the flat plate portion 3a. Each rail portion 3b has a generally arc-shaped cross section, and expands in the inward direction. The rail portions 3b, 3b are inserted between the rail portions 2b, 2b such that an outer face of each rail portion 3b faces the inner face of each rail portion 2b in the vertical direction. The rail portions 3b, 3b can be inserted between the rail portions 2b, 2b of the first rail 2 from the distal end portions of the

rail portions 2b, 2b, such that rear end portions of the rail portions 3b serves as a distal end portions. In this case, the rail portions 3b, 3b can be easily inserted between the rail portions 2b, 2b by contact of the outer faces of the rail portions 3b, 3b with the guide members 5, 5, respectively, allowing them to be guided by the guide members 5, 5.

The slider 4 has a ball retention body 4a made of a rigid metal plate material. A plurality of balls 4b made of a steel ball or the like are disposed at both upper and lower sides of the ball retention body 4a, such that the balls 4b are aligned in a line in the back and forth direction. Each ball 4b is rotatably supported by the ball retention body 4a. Further, each ball 4b rotatably contacts faces facing each other of the rail portions 2b, 3b, that is, the inner face of the rail portion 2b and the outer face of the rail portion 3b. Therefore, the slider 4 is supported by the first rail 2 so as to be movable in the back and forth direction, and the slider 4 supports the second rail 3 such that the second rail 3 is movable in the back and forth direction. Consequently, the second rail 3 is supported by the first rail 2 through the slider 4 so as to be movable in the back and forth direction, whereby the drawer B is supported by the body A by the pair of slide rails 1, 1 so as to be movable in the back and forth direction.

A moving range in the backward direction of the slider 4 is restricted by contact thereof to a stopper plate portion 2c, and a moving range in the forward direction thereof is restricted by contact thereof to a stopper pawl portion 2e formed projecting toward the front end of the inner face of the flat plate portion 2a. A moving range in the backward direction of the second rail 3 is restricted by contact thereof to the stopper plate portion 2c, and a moving range in the forward direction thereof is restricted by the stopper apparatus 6 according to the present invention.

The stopper apparatus 6 is configured by the aforementioned pair of lock plate portions 2d, 2d, and a stopper member 7 formed in the second rail 3. The stopper member 7, made of an elastic metal plate material, is

provided with an attachment plate portion (attachment portion) 7a fixed with a screw (not shown) or the like at the rear end portion of the inner face of the flat plate portion 3a, that faces the flat plate portion 2a, a sloping plate portion (plate portion) 7b which is integrally formed so as to be continuous with the front end portion (i.e., distal end portion) of the attachment plate portion 7a and which extends in the forward direction, and an operation plate portion 7c which is integrally formed so as to be continuous with the front end portion of the sloping plate portion 7b and which extends in the forward direction.

The sloping plate portion 7b is formed so as to be continuous with the attachment plate portion 7a, being bent with respect to the attachment plate portion 7a. The sloping plate portion 7b is inclined such that the front end portion of the sloping plate portion 7b is closer to the flat plate portion 2a of the first rail 2 than the rear portion thereof in a state where the attachment plate portion 7a is attached to the inner face of the flat plate portion 3a, that faces the flat plate portion 2a. A square lock hole (lock recess portion) 7d is formed in the front end portion of the sloping plate portion 7b. The lock hole 7d is disposed such that when the second rail 3 moves in the forward direction to a second position as shown in FIG. 5, the lock hole 7d faces the lock plate portion 2d. Further, the lock hole 2d has a size allowing the two lock plate portions 2d, 2d to get in and come out of the lock hole 2d, simultaneously. Therefore, in a state where the second rail 3 moves to the second position, when the front end portion of the sloping plate portion 7b is rotated to the flat plate portion 2a side of the first rail 2 around the base end portion of the sloping plate portion 7b, the two lock plate portions 2d, 2d are received in the lock hole 7d.

An elastic strip 7e is formed at a portion slightly front of the lock hole 7d on each of the upper and lower side portions of the sloping plate portion 7b. The elastic strip 7e is inclined such that the front portion of the elastic stirp 7 is closer to the flat plate portion 3a than the rear portion

thereof. The elastic stirp 7e is formed so as to be elastically deformed such that the front end portion thereof is rotated around the base end portion and displaced in the direction in which the flat plate portion 2a of the first rail 2 and the flat plate portion 3a of the second rail 3 face each other (in the right and left direction).

The elastic strip 7e is disposed such that when the second rail 3 moves in the forward direction to the first position as shown in FIG. 3, a face of the elastic strip 7e, that faces the flat plate portion 2a, contacts the rear end portion of the distal end face (the distal end face in the direction in which the lock plate portion 2d rises). Therefore, when the second rail 3 moves forward further than the first position, the elastic strips 7e, 7e slide on the distal end faces of the lock plate portions 2d, 2d, respectively. At this time, each elastic strip 7e is inclined such that the front portion thereof is closer to the flat plate portion 3a than the rear portion thereof. Therefore, when the second rail 3 moves forward further than the first position, the elastic strip 7e is pressed to the flat plate portion 3a side by the lock plate portion 2d in accordance with movement of the second rail 3. By this, the sloping plate portion 7b is elastically deformed such that the front end portion of the sloping plate portion 7b is rotated around the base end portion and displaced to the flat plate portion 3a side. As apparent from this, in the first embodiment, the elastic strip 7e also serves as the guide portion. Note that, when the front end portion of the sloping plate portion 7b is displaced to the flat plate portion 3a side, the elastic strip 7e is accordingly displaced to the flat plate portion 3a side.

When the second rail 3 further moves in the forward direction, and the lock plate portion 2d has relatively climbed over the base end portion of the elastic strip 7e, the sloping plate portion 7b slides on the rear end portion of the distal end face of the two lock plate portions 2d, 2d. The sloping plate portion 7b is inclined such that the front portion thereof is closer to the flat plate portion 2a than the rear portion thereof. Therefore, when the

sloping plate portion 7b slides on the lock plate portion 2d, the sloping plate portion 7b is elastically deformed so as to return to the original position such that the front end portion of the sloping plate portion 7b approaches the flat plate portion 2a in accordance with movement of the second rail 3 in the forward direction. Subsequently, when the second rail 3 moves forward to the second position as shown in FIG. 5, the lock plate portions 2d, 2d face the lock hole 7d. At this time, the sloping plate portion 7b maintains a state where the sloping plate portion 7b is elastically deformed toward the flat plate portion 3a. Therefore, when the lock plate portions 2d, 2d face the lock hole 7d, the front end portion of the sloping plate portion 7b is displaced so as to return to the original position such that the front end portion thereof approaches the flat plate portion 2a by an amount equivalent to an amount of elastic deformation of the sloping plate portion 7b. As a result, the plate portions 2d, 2d are received in the lock hole 7d. In this case, since the sloping plate portion 7b is inclined such that the front end portion thereof is closer to the flat plate portion 2a than the rear portion thereof, a distance for which the lock plate portion 2d is inserted in the lock hole 7d (hereinafter referred to as an insertion distance) is the smallest at the rear end portion of the lock plate portion 2d and the largest at the front end portion. When the sloping plate portion 7b is displaced so as to return to the natural condition where no outer force acts thereon, the rear end portion of the lock plate portion 2d is inserted in the lock hole 7d for an insertion distance L1 as shown in FIG. 5.

In a state where the lock plate portion 2d is inserted in the lock hole 7d, when an attempt is made to move the second rail 3 in the forward direction, the rear end face of the lock hole 7d contacts the rear end face of the lock plate portion 2d. Accordingly, the second rail 3 is inhibited from moving in the forward direction. On the contrary, when an attempt is made to move the second rail 3 in the backward direction, the front end face of the lock hole 7d contacts the rear end face of the lock plate portion 2d.

Accordingly, the second rail 3 is inhibited from moving in the backward direction. Moreover, the lengths of the lock plate portion 2d and the lock hole 7d in the back and forth direction are set to a substantially similar value. Therefore, in a state where the lock plate portion 2d is inserted in the lock recess portion 7d, the second rail 3 rarely moves in the back and forth direction.

Front end portions of the elastic strips 7e, 7e are inserted, with a gap, into through holes 3c, 3c that are formed in the flat plate portion 3a of the second rail 3, respectively, when the stopper member 7 is in the natural condition. Therefore, when the lock plate portion 2d is inserted in the lock hole 7d, the elastic strip 7e is separated from the inner face of the flat plate portion 3a and the inner peripheral face of the through hole 3c. This is because the stopper member 7 is in the natural condition when the lock plate portion 2d is inserted in the lock hole 7d. A distance between the elastic strip 7e and an intersection portion of the inner face of the flat plate portion 3a and the inner peripheral face of the through hole 3c in the right and left direction (that is, the direction in which the flat plate portions 2a, 3a face each other) is the smallest at an intersection portion (abutment portion) 3d of the rear end portion of the inner peripheral face of the thorough hole 3c and the inner face of the flat plate portion 3a. When a separation distance between the elastic strip 7e and the intersection portion 3d in the right and left direction is assumed to be L2, the insertion distance L1 and the separation distance L2 as described above have a following relation.

$L1 > L2$

Therefore, when the second rail 3 moves from the first position toward the second position and reaches a predetermined intermediate position for a predetermined distance (that is, a distance in the backward direction corresponding to an angle of gradient of the elastic strip 7e and the separation distance L2), the elastic strip 7e is forced to move toward the flat plate portion 3a by the distance L2. Therefore, the front end portion of the

face, of the elastic strip 7e, which faces the flat plate portion 3a, abuts against the intersection portion 3d. After this, until the base end portion of the elastic strip 7e (that is, the intersection portion of the elastic strip 7e and the sloping plate portion 7b) slides over the lock plate portion 2d, the elastic strip 7e is forced to abut against the intersection portion 3d more strongly in accordance with movement of the second rail 3 in the forward direction. After the base end portion of the elastic strip 7e slided over the lock plate portion 7d, the sloping plate portion 7b is deformed so as to return to the flat plate portion 2a side, and accordingly the elastic strip 7e is also deformed so as to return to the flat plate portion 2a side. However, the elastic strip 7e abuts against the intersection portion 3d and remains elastically deformed, even when the second rail 3 reaches the second position. Therefore, when the second rail 3 moves in the forward direction to the second position and the lock plate portion 2d faces the lock hole 7d, the sloping plate portion 7b is deformed so as to return to the flat plate portion 2a side not only by elasticity of the sloping plate portion 7b itself, but also by elasticity of the elastic strip 7e. When the sloping plate portion 7b is displaced so as to return toward the original position by a distance (L1-L2), the elastic strip 7e separates from the intersection portion 3d. Therefore, after this, the sloping plate portion 7b is deformed so as to return to the original position only by elasticity of itself.

The operation plate portion 7c is formed so as to be continuous with the sloping plate portion 7b, being bent with respect to the sloping plate portion 7b. The operation plate portion 7c is inclined such that the front end portion thereof is closer to the flat plate portion 3a than the rear portion thereof. The operation plate portion 7c may be formed in parallel with the flat plate portions 2a, 3a. The width of the operation plate portion 7c is slightly smaller than a distance between the pair of lock plate portions 2d, 2d. The operation plate portion 7c is received between the pair of lock plate portions 2d, 2d so as to be movable in the back and forth direction and the

right and left direction, when the second rail 3 is positioned at or in the vicinity of the first position. Moreover, as shown in FIG. 5, when the second rail 3 is positioned at the second position, the operation plate portion 7c projects from the flat plate portion 2a in the forward direction. Therefore, it is possible to move the operation plate portion 7c toward the flat plate portion 3a side, for example, by pressing it with a finger. The lock plate portion 2d can get out of the lock hole 7d by pressing the operation plate portion 7c to the flat plate portion 3a side so as to elastically displace the sloping plate portion 7b to the flat plate portion 3a side. The lock plate portion 2d can get out of the lock hole 7d if the operation plate portion 7c is pressed to the flat plate portion 3a side, until immediately before the front end portion of the operation plate portion 7c contacts the flat plate portion 3a. Therefore, the lock plate portion 2d can reliably get out of the lock hole 7d by pressing the operation plate portion 7c to the flat plate portion 3a side until the front end portion of the operation plate portion 7c contacts the flat plate portion 3a.

Assume that, in the slide rail 1 having the stopper apparatus 6 with the aforementioned structure, the second rail 3 is positioned rearward of the first position. When the second rail 3 is moved in the forward direction from the state above to the first position, as shown in FIG. 3, the elastic strip 7e contacts the rear end portion of the distal end face of the lock plate portion 2d. When the second rail 3 is moved further in the forward direction, the elastic strip 7e is pressed to the flat plate portion 3a side by the lock plate portion 2d. Accordingly, the sloping plate portion 7b is elastically deformed such that the front end portion of the sloping plate portion 7b approaches the flat plate portion 3a. When the sloping plate portion 7b is elastically deformed, in accordance with this deformation, the elastic strip 7e moves so as to approach the intersection portion 3d. Subsequently, when the second rail 3 reaches the intermediate position, the sloping plate portion 7b is further elastically deformed to the flat plate portion 3a side, and the elastic strip 7e

abuts against the intersection portion 3d. After this, until the elastic strip 7e slides over the lock plate portion 2d, elastic deformation amounts of the sloping plate portion 7b and the elastic strip 7e gradually increase in accordance with movement of the second rail 3 in the forward direction. After this, until the second rail 3 reaches the second position, although elastic deformation amounts of the sloping plate portion 7b and the elastic strip 7e gradually decrease, the sloping plate portion 7b and the elastic strip 7e remain elastically deformed (see FIG. 4). Moreover, the elastic strip 7e contacts the intersection portion 3d.

When the second rail 3 reaches the second position and the lock plate portion 2d faces the lock hole 7d, the sloping plate portion 7b is deformed such that the front end portion thereof approaches the flat plate portion 2a by elastic force of the sloping plate portion 7b and elastic force of the elastic strip 7e. Consequently, the lock plate portion 2d is relatively inserted in the lock hole 7d. As described above, when the second rail 3 moves in the forward direction to the second position, the sloping plate portion 7b is moved to the flat plate portion 2a side, not only by elastic force of the sloping plate portion 7b itself, but also by elastic force of the elastic strip 7e. Therefore, the lock plate portion 2d can be reliably inserted in the lock hole 7d. Note that in the state where the lock plate portion 2d is inserted in the lock hole 7d, when an attempt is made to move the second rail 3 further in the forward direction, the rear end face of the lock plate portion 2d and the rear end face of the lock hole 7d contact each other. Therefore, the second rail 3 is inhibited from moving in the forward direction. It is needless to say that movement of the second rail 3 in the backward direction is also inhibited by contact of the front end face of the lock plate portion 2d and the front end face of the lock hole 7d with each other.

In the case of causing the lock plate portion 2d to get out of the lock hole 7d, when the sloping plate portion 7b is displaced to the flat plate portion 3a side by the distance L2, the elastic strip 7e abuts against the

intersection portion 3d. Therefore, when an attempt is made to cause the lock plate portion 2d to get out of the lock hole 7d by moving the second rail 3 in the forward direction from the second position, the sloping plate portion 7b needs to be displaced by the distance (L1-L2) resisting the elastic force of the sloping plate portion 7b and the elastic force of the elastic strip 7e. Therefore, the state where the lock plate portion 2d is inserted in the lock hole 7d is reliably maintained. On the other hand, there is a case where an attempt is made to move the second rail 3 in the backward direction from the second position whereby the lock plate portion 2d gets out of the lock hole 7d. In this case, when an insertion distance of the front end of the lock plate portion 2d with respect to the lock hole 7d is L3 (see FIG. 5), the sloping plate portion 7b needs to be displaced by a distance (L3-L2) resisting the elastic force of the sloping plate portion 7b and the elastic force of the elastic strip 7e. Here, since the sloping plate portion 7b is inclined such that the front end portion thereof is closer to the flat plate portion 2a than the rear portion thereof, the following relation is applied.

$L3 > L2$

Therefore, when moving the second rail 3 in the backward direction from the second position, the state where the lock plate portion 2d is inserted in the lock hole 7d is more reliably maintained.

Further, the sloping plate portion 7b is displaced so as to return to the flat plate portion 2a side, not only by the elastic force of the sloping plate portion 7b itself, but also by the elastic force of the elastic strip 7e. Therefore, it is possible to easily deform the sloping plate portion 7b by reducing the modulus of elasticity. Accordingly, it is possible to prevent the sloping plate portion 7b from being damaged at the intersection portion of the sloping plate portion 7b and the attachment plate portion 7a at an early stage.

Note that in the state where the lock plate portion 2d is inserted in the lock hole 7d, as shown in FIG. 6, the lock plate portion 2d can get out of the lock hole 7d by pressing the operation plate portion 7c to the flat plate

portion 3a side and moving the front end portion of the sloping plate portion 7b resisting the elastic force of the sloping plate portion 7b and the elastic force of the elastic strip 7e. By causing the lock plate portion 2d to get out of the lock hole 7d, the second rail 3 is capable of moving in the back and forth direction from the second position.

Next, other embodiments of the present invention will be explained. Note that, for those embodiments, only the structure which is different from that of the first embodiment will be explained hereafter. Similar structural elements will be denoted by the same numerals and the explanation thereof will be omitted.

FIG. 7 shows a second embodiment of the present invention. In a slide rail 1A of the present embodiment, a stopper member 7A is used in place of the stopper member 7 which is used in the aforementioned embodiment. In the stopper member 7A, in place of the lock hole 7d, a pair of lock recess portions 7f, 7f are formed in upper and lower side portions of the sloping plate portion 7b, respectively. It is needless to say that the lock recess portions 7f, 7f are disposed such that when the second rail 3 moves in the forward direction to the second position, the lock plate portions 2d, 2d are received in the lock recess portions 7f, 7f, respectively.

FIG. 8 shows a third embodiment of the present invention. In a slide rail 1B of the present embodiment, a stopper member 7B is used in place of the stopper member 7. In the stopper member 7B, when the second rail 3 moves in the forward direction to the first position, the operation plate portion 7c contacts the lock plate portion 2d. After this, until the time when the base end portion of the operation plate portion 7c slides over the lock plate portion 2d, the operation plate portion 7c is pressed by the lock plate portion 2d to the flat plate portion 3a side in accordance with movement of the second rail 3 in the forward direction whereby the sloping plate portion 7b is elastically deformed to the flat plate portion 3a side. As apparent from this, in the slide rail 1B, the operation plate portion 7c also serves as the

guide portion. Further, in the slide rail 1B, in place of the two elastic strips 7e, 7e, a single elastic strip 7g is formed in the stopper member 7B. The elastic strip 7g is disposed at a central portion in the width direction of the stopper member 7B. The base end portion of the elastic strip 7g is integrally formed with the sloping plate portion 7b at a portion facing the front end portion of the lock hole 7d of the sloping plate portion 7b, and the front end portion of the elastic strip 7g extends toward the rear of the slide rail 1B. Moreover, the elastic strip 7g is inclined such that the rear portion thereof is closer to the flat plate portion 3a than the front portion thereof. The distal end portion of the elastic strip 7g is press-contacted with the inner face of the flat plate portion 3a, by elastic force of the elastic strip 7g itself. Therefore, a portion, which is press-contacted by the elastic strip 7g of the inner face of the flat plate portion 3a constitutes an abutment portion. In this case, the elastic strip 7g is always press-contacted with the flat plate portion 3a, however, it does not need to be always press-contacted with the flat plate portion 3a. It is sufficient if the elastic strip 7g is press-contacted with the flat plate portion 3a when the second rail 3 is positioned between the intermediate position and the second position. Note that the elastic strip 7g is inserted between the lock plate portions 2d, 2d so as to be movable in the back and forth direction and the right and left direction when the second rail 3 is positioned at or in the vicinity of the second position.

FIG. 9 shows a fourth embodiment of the present invention. A slide apparatus 1C according to the fourth embodiment is a modified version of a slide 1' such that the whole slide apparatus 1' is movable in the back and forth direction. The slide apparatus 1' is slightly modified from the slide apparatus 1 according to the first embodiment. That is, in the slide apparatus 1C, a fixed rail 8, a movable rail 9 and a slider 10 are added to the slide apparatus 1'. The fixed rail 8 is fixed to a side face of the housing portion A1 (see FIG. 2) such that the longitudinal direction thereof is in alignment with the back and forth direction. The movable rail 9 is disposed

such that the longitudinal direction thereof is in alignment with the back and forth direction, it faces the fixed rail 8. The movable rail 9 is supported by the fixed rail 8 through the slider 10 so as to be movable in the back and forth direction. The first rail 2 is fixed to the movable rail 9 such that the longitudinal direction of the first rail 2 is in alignment with the back and forth direction whereby the first rail 2 is movable in the back and forth direction and the whole slide apparatus 1' is also movable in the back and forth direction. Moreover, in place of the lock plate portion 2d, a lock protruding portion (lock portion) 2f is formed in the first rail 2 of the slide apparatus 1'. The lock protruding portion 2f, formed in a rectangular parallelepiped, has the same shape and dimension as a member which is formed by filling a gap between the two lock plate portions 2d, 2d. Therefore, the lock protruding portion 2f is capable of getting in and coming out of the lock hole 7f. The other structure of the slide apparatus 1' is the same as the slide apparatus 1.

Note that the present invention is not limited to the aforementioned embodiments, and modification of the embodiments is possible as necessary, as long as it does not deviate from the gist of the embodiment.

For example, in the aforementioned embodiments, the sloping plate portion 7b, which is inclined such that the front portion thereof is closer to the flat plate portion 2a than the rear portion thereof, is employed as a plate portion. However, in place of the sloping plate portion 7b like this, a plate portion with a step-like bent shape may be employed. The plate portion may be structured such that it is bent at a substantially right angle at the front end portion of the attachment portion 7a so as to approach the flat plate portion 2a side, and subsequently it is bent at a substantially right angle so as to extend in the forward direction along the flat plate portion 2a.

Further, according to the first and second embodiments, the front end portion of the elastic strip 7e is separated from the intersection portion 3d when the sloping plate portion 7b is in the natural condition. The front end

portion of the elastic strip 7e may contact the intersection portion 3d even when the sloping plate portion 7b is in the natural condition.

Moreover, in the aforementioned embodiments, the elastic strip 7e or the operation plate portion 7c serves also as the guide portion. Instead, a guide portion which is independent of the elastic strip 7e and the operation plate portion 7c may be formed in the stopper member 7.